

S p e c i f i c a t i o n

Be It Known That I, **LESTER V. BROERSMA** a citizen of the United States of America, resident of County of San Diego, State of California, have invented a new and useful

AUTO-ADAPTING TUBE FITTING

5 of which the following is a specification:

Field of the Invention

This invention relates to pipe fittings and more specifically to those fittings which accommodate different size pipe ends such as those which exist on the outlet ports 5 of detachable ammunition magazines for paintball guns.

Background of the Invention

The ever-increasing popularity of war games in which frangible paintballs are shot to mark a living target, has 10 prompted many improvements designed to enhance the rapid and sustained firing of a large quantity of paintball projectiles. As shown in Figure 1, most recent models of paintball guns 1 use a substitutable magazine 2 for carrying a quantity of spherical paintball projectile ammunition 3 15 as disclosed in Lorenzetti, U.S. Patent No. 5,166,457 incorporated herein by this reference. The magazine 2 mounts to the upper section of the gun by engaging its tubular outlet port 4 to the tubular feed port 5 of the gun. When so mounted, both ports are generally arranged coaxially 20 to form a cylindrical passage through which the projectiles freely flow.

Magazines are often manufactured having dissimilarly dimensioned outlet port tubes thereby resulting in a magazine which is loosely fitted to the gun which can allow 25 for unintentional disorientation or even dislodgement of the magazine leading to an interruption in rapid and sustained

firing.

Various solutions have been proposed including intermediate adapters having opposite ends each sized to fit particular magazine sizes to various gun feed port tube sizes. Such solutions increase the bulkiness of the magazine and typically require the user to have a different adapter for each different size magazine. Further, such adapters often increase the length of the cylindrical passage. The change in the diameter of the passage can lead to fouling or otherwise less than a smooth rapid flow of paintballs.

The present invention is an attempt to overcome the above-identified problems.

15 **Summary of the Invention**

The principal and secondary objects of this invention are to provide a simple, easy to use, lightweight, non-bulky, reusable, and inexpensive to manufacture auto-adapting fitting for use on a paintball gun feed port which releasably but snugly engages magazine outlet ports in a range of sizes.

These and other objects are achieved by a fitting having an elastomeric sleeve-shaped collar having a number of radially, inwardly extending projections that pass through corresponding radially penetrating holes through the side wall of the end portion of a feed port tube near its

upper opening. The projections bear against the outer surface of the magazine outlet port tube. Magazine outlet tubes having a larger outer diameter will cause the collar to be resiliently pushed outwardly. The projections are shaped to have a downward and inward taper to encourage easy insertion of the outlet tube. The resiliency of the collar is axially variable to cause a greater inwardly biasing force proximate to the thickened portion of the projection.

10 **Brief Description of the Drawing**

Figure 1 is a prior art diagrammatic side view of a magazine being attached to a paintball gun;

15 **Figure 2** is a diagrammatic perspective view of an auto-adapting fitting formed upon a top open end of a paintball gun feed port tube according to the invention;

Figure 3 is a diagrammatic perspective exploded view of the auto-adapting fitting of **Figure 2**;

20 **Figure 4** is a diagrammatical top cross-sectional view of the fitting of **Figure 2** taken along line 4-4 and being distended by an engaged magazine outlet tube;

Figure 5 is a diagrammatical top cross-sectional view of a fitting according to an alternate embodiment of the invention having a single prominence.

25 **Figure 6** is a diagrammatical top cross-sectional view of a fitting according to an alternate embodiment of the invention having two non-evenly spaced-apart prominences.

Figure 7 is a diagrammatical top cross-sectional view of a fitting according to an alternate embodiment of the invention having two evenly spaced-apart prominences.

5 Figure 8 is a diagrammatical top cross-sectional view of the fitting engaged by an outlet tube and showing an exaggerated deformation of the collar;

Figure 9 is a diagrammatical cross-sectional side view of a portion of the auto-adapting collar of Figure 4 taken along line 9-9;

10 Figure 10 is a diagrammatical cross-sectional side view of a portion of the collar of Figure 8 taken along line 10-10.

Description of the Preferred Embodiment of the Invention

Referring now to the drawing, there is shown in Figures 15 2-5 an auto-adapting fitting 10 for releasably connecting in a substantially coaxial, end-to-end orientation, a first feed port tube end 11 formed onto a paintball gun to a second outlet port tube end 12 formed by a paintball hopper or magazine outlet port. The fitting comprises a resilient sleeve-shaped collar 15 having a number of angularly and evenly spaced-apart radially, inwardly extending prominences or projections 16 that pass through corresponding radially penetrating holes 17 through the sidewall 18 of the upper end portion of the feed port tube 11 near its upper opening 19. The collar acts as a clamping structure so that the projections are inwardly biased to bear against the outer

surface 13 of the magazine outlet tube 12.

The dimensions of the fitting are selected to accommodate outlet tubes having an outer diameter within a specified range. The radial length of each extension is selected so that acting in concert, they contact outlet tubes having an outer diameter at the lower limit of the range. The upper limit of the range is the inner diameter of the feed tube port upper end 11. The inside diameter of the lower portion 14 of the feed tube is preferably selected to be greater than or equal to the upper limit of the inside diameter of the outlet tube size ranges.

The collar is preferably made from a durable, slightly resilient material such as polyurethane plastic. The feed tube of the paintball gun is formed from durable, rigid material such as steel.

Referring now to Figure 4, an outlet tube 12 inserted into the fitting contacts the most radially inwardly located surfaces 20 of the projections 16. Since the outer diameter of the outlet tube 12 is larger than the radially inwardmost surfaces 20 of the collar, the projections are forced outwardly. Due to the resilient nature of the collar, it provides a positive friction contact between the collar 15 and the outlet tube 12 resisting the outlet tube's dislodgement.

Referring now to Figure 5, those skilled in the art will readily appreciate implementation of the invention

wherein a collar 21 has a single prominence 22 is used to force the outlet tube 23 to one side which is roughly in axial alignment with the feed tube 24. Further, referring to Figure 6, two prominences 25 which are non-equidistantly spaced apart can provide a more stable engagement of a feed tube 26. The location of the center of the feed tube below the fitting should be selected to provide for the least off-center alignment for outlet tubes within the selected range. In other words, when using a fitting such as in Figures 5 and 6, the upper portion of the feed tube is not coaxial with the bottom portion of the feed tube, but rather with the expected axis of the attached outlet tube. The disadvantage of the embodiments of Figures 5 and 6 are that a different sized outlet tube will have a slightly different off-center alignment.

Referring now to Figure 7, in order to encourage more precise coaxial centering of the connected tubes, the collar preferably has at least two evenly spaced apart prominences 27, 28. In this way, webbing portions 29, 30 of the collar between the prominences contact the outer surface of the feed tube 31 and thereby encourage centering of the outlet tube 32. When evenly spaced apart, an even number of prominences provide a diametrically opposing clamping force between opposite pairs. An odd number of prominences avoids diametrically opposing clamping forces.

More prominences will provide a more radially

distributed clamping force. Most preferably, the collar has at least six prominences.

As shown in an exaggerated fashion in Figure 8, the dimensions of the collar 35 can be selected so that webbing portions 36 between the projections 37 are stretched and flattened by the outward movement of the projections. A central region 28 of a webbing portion contacts the outer surface 39 of the feed tube 40 thereby centering the positioning of the outlet tube 41 within the feed tube.

A fewer number of prominences will allow the webbing of a collar made from a material having a particular resiliency to more consistently contact the outer surface of the feed tube.

Referring now to Figure 9, the collar 15 is preferably shaped so that each projection 16 has an axially medial hump 45 gradually formed by an inwardly facing surface 46 tapering or gently sloping from its distal extremities 47 to the hump. This tapered surface forms an angle A from the vertical of between about 1 and 5 degrees. This shape allows for easier insertion of oversized outlet tubes into the fitting since an upper portion of the prominence is more outwardly located than lower portion near the hump. The outer surface 48 of the collar is shaped to have a axially medial bulge 49 so as to cause greater radial stiffness in the axially medial portion 50 of the collar. As shown in Figure 10, this causes a deformation of the central hump of

the projection 37 thereby causing more flattened zone of contact 51 with the outlet tube 41.

The preferred collar is also axially symmetric about a plane normal to the central axis at the hump to allow 5 installation in a flipped orientation.

While the present invention has been described as a fitting formed onto the feed port of the gun, those skilled in the art will readily appreciate that the invention can be easily adapted to form onto the outlet port of the magazine.

10 While the preferred embodiment of the invention has been described, modifications can be made and other embodiments may be devised without departing from the spirit of the invention and the scope of the appended claims.

15 **WHAT IS CLAIMED IS:**